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Understanding the Rafale kills

Alan Warnes gained rare and exclusive access to the Pakistan Air Force in mid-July, to understand how it managed to shoot down six Indian Air Force fighters on the night of May 6/7

With vapour streaming from its wing tips, this camouflaged Chengdu J-10C looks every inch the deadly fighter it was on May 6/7 *All images Alan Warnes unless stated*

PAF Commander, ACM Zaher Ahmed Baber Sidhu has revolutionised the PAF over the past four years. *PAF*

India v Pakistan

"We ambushed them," a high-ranking PAF officer told me in mid-July. "We trapped them in our kill chain and created chaos."

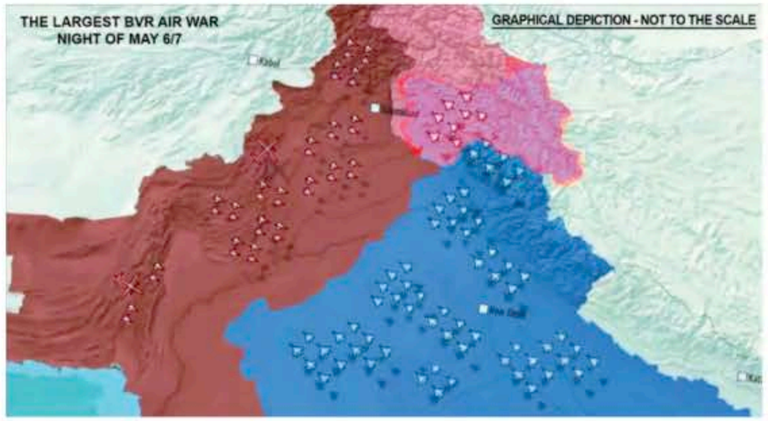
That's how the PAF claims it shot down six Indian Air Force (IAF) fighters in the early hours of May 7, when the biggest beyond visual range (BVR) air battle was contested on Pakistan's border with India.

The IAF had launched Operation Sindoor (Sindoor being an orange/red powder worn by Hindu women). The PAF retaliated with a counter-operation, Operation Bunyan-un-Marsoos, (an Arabic phrase meaning a solid structure, derived from the Quran.)

More than 114 fighters were involved - 72 IAF and 42 from the PAF - most believed to be fitted with BVR missiles developed by the French, Israelis, Russians and Chinese.

The senior officer said: "Fifty-two minutes after the air war had started, the fight was over, we won and they headed home.

"We could have shot down more Rafales than we did, but we held back. An escalation could have led to all-out war between two nuclear nations. During Op Bunyan-un-Marsoos we targeted the Rafales and the S-400s [Russian air defence system] and it worked out well!"



On May 6/7 the two air forces faced off, looking across their borders in formations like this PAF

Unfolding air war

India had been seeking revenge for the Pahalgam terror attack that took place in Indian-administered Kashmir on April 22, when five armed terrorists killed 26 mainly Hindu civilians. India's government, led by Prime Minister Narendra Modi, blamed Pakistan for this atrocity and he, along with the majority of the Indian public seemingly, wanted revenge.

"We watched while on full alert, waiting for a response," the PAF officer told me. For six tense days, the PAF monitored the build-up of transport aircraft, supporting large deployments of fighters to several IAF Western Command and South-Western Command bases. They knew an attack was imminent and were prepared for it.

Each of the four Air Commands – North, Central, South and West – operates deployable command and control (C2) centres, capable of directing operations across vast distances. Among their many functions one stood out for the author - the long-range vectoring of hypersonic missiles, like the CM-400AKGs that the PAF JF-17C Thunder jets launched at some of the most formidable assets in India's arsenal. They included the highly advanced Russian-built S-400 air defence systems (see *The S-400 Quandary*, pages 38-41).

The author was granted rare access to one of the deployable C2 centres, witnessing first-hand how it functioned. It is part of the PAF

The PAF Commander's inner circle in the wake of the air battle with the IAF on May 7. This is the Multi Domain Ops room, where all the data was fed in from different sensors PAF

The PAF Commander, ACM Zaheer Ahmed Baber Sidhu in the National ISR and Integrated Air Ops Center (NIIACC) during Op Bunyan-un-Marsoos PAF

Chief of the Air Staff, Air Chief Marshal Zaheer Ahmed Baber Sidhu's integrated multi-domain operations philosophy he has pursued since becoming PAF Commander in March 2021 – for more on that see later. An Air Vice Marshal from the newly created Space Force added: "The C2 centres are reliable and robust and can see across the border into India, but I won't disclose the range due to the sensitive nature. Fusing data with our new unmanned, space, EW and cyber commands means they are effectively our nerve centres."

PAF's Space Command has redefined the battlespace. Using indigenous satellites, it delivers round-the-clock intelligence, surveillance and reconnaissance (ISR) support. The Global Navigation Satellite System (GNSS), datalinks real-time information to PAF aircraft bypassing the limitations of the line-of-sight communication. Through secure SATCOM connectivity, pilots not only gain unmatched situational awareness but also offensive capabilities like electronic attack. It's a central piece of the PAF's Link 17 (and the enhanced Skyguard system), fed to the JF-17s, J-10Cs and Erieye to provide pilots with the situational awareness needed to win a war.

This means every cockpit receives a Recognised Air Picture through encrypted datalinks, ensuring PAF aircrew possess the tactical clarity needed to dominate the skies. This fusion of space, cyber, electronic warfare (EW) and kinetic power has turned the PAF into a truly multi-domain combat force, capable of deterring, responding and prevailing in future wars, which seems highly likely. This capability has been built up since the author's last visit in 2020 and was clearly revolutionising the way PAF the trains and goes to war.

Several military veterans the author spoke to were keen to stress that the PAF is just part of the fighting machine run by the Chief of Army Staff, Field Marshal Asim Munir who made a high-profile visit to the USA in mid-August. He harnesses the combined strengths of Army, Navy and Air Force, but this feature focusses on the PAF.

EW at work

On April 29, a week after the Pahalgam attack, four IAF Rafales departed Ambala Air Force Station. Their mission, to bomb terrorist targets in the north, but according to the PAF, a mobile PAF electronic warfare (EW) unit deployed

All new air doctrine is created and tested at the PAF's ACE facility, based at Mushaf, that has a huge tactical training range - one of the best in the world according to the Turkish Air Force (see last month's Anatolian Eagle exercise report)

The PAF operates 20 J-10C Vigorous Dragons in both camouflaged and grey markings. None currently wear squadron markings but that could change soon. This aircraft, with its light blue underbelly, taxies to the end of the Minhas runway for a mission

A grey J-10C with six hard-points under the wings, two equipped with twin missile racks. During the author's time at Minhas, a grey example always flew with a camouflaged jet

along the front line saw them approaching and jammed their radars and communications, while cyber-attacks on electric grids in the north, rendered the Rafales helpless. They abandoned their mission and instead diverted to Srinagar Air Force Station.

The Dassault 20ECMs of 24 'Blinders' Squadron which had performed so well in Op Swift Retort in February 2019 (see panel) were not used in Operation Bunyan-un-Marsoos because of their lack in wattage power. Trying to overpower a target receiver is heavily influenced by the power output, and a lack of this power will make the jammer less effective at disrupting intended signals. This would have been the case with the S-400 air defence system or Rafale's Thales RBE2 radar, which MBDA designed to be robust against jamming, and integrated with the passive Thales Spectra EW system.

The EW mobile units designed by the new NASTP (National Aerospace Science & Technology Park) in recent years, instigated by the PAF's Commander, ACM Sidhu, were being fielded at various locations to jam targets. Between April 29, when the IAF tried their failed attack, and May 6, the PAF had watched the IAF deploy up to 20 Rafales from Hashimara (home of 101 Sqn in the Eastern Command) to Gwalior and several other bases (Ambala, home of 17 Sqn Rafales in Western Command, Srinagar and Bikaner/Nal in Rajasthan). Several S-400 *SA-21 Growler* surface-to-air missile batteries were moved to Adampur, Bhuj and Bikaner.

The IAF mobilised around 400 aircraft in late April and early May, with the transport fleet flying over 500 sorties, obviously to move around weapons, logistics and personnel for an attack. The PAF was prepared.

At 1230hrs on May 7, that attack came when the IAF bombed nine sites in Pakistan with long-range Spice 2000 precision-guided bombs. The CAS immediately changed the rules of engagement, with airborne PAF fighters instructed to move from defensive to offensive mode. He spoke directly to all the PAF pilots in the air via radio, commanding them to shoot them down, and according to several sources he told the airborne fighter pilots: "Kill them, kill them, don't let them enter even an inch into Pakistan."

The PAF could not let the attack go unpunished, and as the spokesman told me: "No one infringes Pakistani sovereign territory - we are entrusted to protect it.

"When the IAF released those bombs, there were already 72 IAF aircraft in the air, as their numbers had steadily increased. We started the attack on the different strike packages of Rafales, Su-30MKIs and Mirage 2000s."

ACM Sidhu has boosted the PAF's capabilities considerably with his operational and industry visions. He is seen here walking to a F-16 alongside members of his staff and base personnel PAF

Most of the IAF's 36 Rafales were flying in offensive mode on the Indian side of the border at some point and according to the PAF, they were equipped with MBDA's highly capable Meteor BVRAAM, backed up by Su-30MKI *Flankers* armed with Israeli Derby BVR missiles and Spice 2000 precision-guided munitions (PGMs).

According to the ISPR (Inter Services Public Relations) press briefing on May 7, the IAF had eight formations lined up along the eastern border, each strike package comprised eight aircraft: four Su-30MKIs, two Rafales and two Mirage 2000s.

Locking on the target

A senior PAF pilot explained how they prepare for war with India, always a real possibility. "It's in the training," he said. "Going to theatre, the fighter's radar cannot see all the targets as they are too far away, but the Saab 2000 Erieye does."

As a high value asset and undoubtedly a target for India, the Saab 2000 Erieye will keep out of harm's way flying close to the western border, over 400km (250 miles) from India.

He continued: "The operator sitting in front of his screen in the Erieye will label the enemy aircraft into the different groups and assign them to the PAF packages. This will be done in groups of three or four aircraft according to azimuth and altitude, then the operator assesses and relays [the positions] to all the aircraft, but he will still control them.

"The war picture is built through Link 17/ Skyguard, which we see on the displays in our cockpit, and the aircraft we are assigned to shoot – which we term 'the contract'. The Air Boss and his team [in the Multi Domain Ops Room] will also be looking over the scene on a massive screen in AHQ.

"The fighter pilots have two radios in the cockpit, one to discuss the complete aerial picture and another to talk to members in your formation.

"If I am targeting their no 1 and 2, I would see them on my scope, put my cursor on them and lock my missiles onto them.

"My radar is then locked onto the target and

Three J-10C flying line abreast armed with 18 air-to-air missiles between them. The Chinese People's Liberation Army Air Force is now keen to understand how the PAF worked their jets so well operationally

"We could not let the attack go unpunished. No one infringes Pakistani sovereign territory, and we are entrusted to protect it."

With its front wheel lifting off the runway, this J-10C is set for another mission

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The Tactics Developments School is where the anti-Rafale ops are rolled out to PAF personnel. The PAF has always worked harder to define tactics against its Indian foe and no stone is left unturned to ensure that they are successful

is linking info to the missile until a certain range, when the missile switches on to its own AESA [Active Electronically Scanned Array] seeker within the PL-15's minimum abort range [MAR]."

The MAR is the closest an engaging aircraft can get to the target and fire the missile before getting out of a fight, before the missile threat is able to run you down.

"Once your missile's active range (in this case the PL-15) is met, you can turn back (to ensure you don't fly inside the MAR of a Meteor -let's say 35 miles). The missile with its AESA seeker will then lock on to target and shoot it down."

The author was told the Rafale pilots would not have known what hit them until the PL-15Es were about three seconds out.

"Remember, if you miss your designated aircraft, it could get you. We train continuously for this. A mission of 15 minutes can regularly take up to eight hours to debrief!

"In a war theatre you can put as many aircraft as possible up. The IAF sent 72 into the AOR [Area of Responsibility] but it's a lot for the GCIs [Ground Control Interceptors] to control!"

One of the lessons the IAF must have learnt from that night was the sheer number of aircraft they deployed in the air was too much to handle. Each IAF GCI would have to manage several aircraft in an extremely dynamic situation, particularly as aircraft were being shot down. The PAF Commander said: "We designated an IAF aircraft for every J-10 or JF-17 Block 3 with the battle space being managed much better because of the multi domain ops."

Going for the kill

Waiting for the IAF fighters to make their move in the early hours of May 7 were PAF J-10C Vigorous Dragons and JF-17C Thunders, both armed with Chinese PL-15s (CH-AA-10 *Abaddon*) BVRAAMs and shorter-range PL-10s (CH-AA-9 *Azrael*). Behind them were F-16C Block 52s with the shorter range AN/APG-68 radars, equipped with AIM-120C AMRAAMs (Advanced Medium Range Air to Air Missiles).

Highly capable and well-trained pilots from both sides were going into battle with an immense amount of national pride at stake.

As they raced towards each other and the missiles of the Indian fighters went 'hot', the PAF Commander gave the order from the NAIIOC (National ISR Air Ops Centre) to break their data links, which meant they would lose all situational awareness. Jamming from mobile EW units dotted all along the eastern fringes of Pakistan completed the damage.

The Rafale's cutting edge Thales Spectra integrated electronic warfare system was designed to protect the Indian Air Force's jet. The pilot should have been warned by Spectra that something was watching them, and they needed to start taking evasive action. Spectra should have detected the radar of the enemy aircraft's electromagnetic waves. Unless of course the J-10 did not switch on its radar, and the target information was data linked to the fighter that then fired the PL-15. When the missile eventually switched on its AESA seeker in the terminal phase, it would have been too late for the Rafale.

In the Ops room, the PAF Commander instructed a pilot to fire at their selected adversary, visible on the Comprehensive Complete Air Picture (CCAP) screen. The author was shown a recording of a PL-15E leaving the J-10's missile rail and tracking towards the red target. Once the target was hit, the signal would blink intermittently, until it disappeared. All the information on the targets was available to the PAF.

As one retired officer stated: "They were sitting ducks - they didn't stand a chance when our J-10Cs unleashed those PL-15s. Our Multi Domain Ops ensured the IAF pilots couldn't perform in the air battle."

The radar range of both the J-10C's KLJ-10 and the Rafale's RBE2 is believed to be around 200km (125 miles). According to the PAF, not one Meteor was fired at the PAF fighters. The PL-15Es hit their targets at between 160 and 190km (100 and 120 miles) out (close to the maximum kinetic range of the export version of PL-15), and with the Meteor's range only being about 150km, you can understand why. The PL-15E had an edge of about 40-50km and the IAF fighters were downed over Indian territory. The PL-15 is certainly faster than the Meteor so that would be another factor. The PAF effectively trapped the IAF pilots in their 'kill chain'.

Three of the IAF's satellites were by now under PAF control, using its indigenously developed systems. The downlinks were subsequently severed and the GPS signals were neutralised. At the same time, the PAF's cyber warriors launched a sweeping offensive, crippling 96%

Indian Air Force losses

4 x Rafale EH
1 x Su-30MKI
1 x MiG-29UPG
1 x Mirage 2000H
1 x Heron Mk2

Preparing the PAF for Full Spectrum Air Ops, the Aerospace Power Centre of Excellence has all the elements of the PAF offensive force. The J-35 and ASOJ (Airborne Stand Off Jammer) are both listed. While ASOJ has been contracted with Turkey, the J-35 is still being studied

A J-10C sits on the edge of the 15 (Multi Role) Squadron shelter area, armed and looking very dangerous, Clearly visible is the IRST sensor on the nose and the air-to-air refuelling probe PAF

of India's social networks, penetrating critical systems, and even disrupting the country's railways, airlines, banks and energy grids to sow chaos. Bold messages flashed across Indian CCTV screens, while websites were defaced and key digital nodes were struck, triggering electricity blackouts across vast regions of India. This was the first time any Air Force in the world had synced its cyber operations with its kinetic operations.

PAF Cyber Ops had shifted into offensive mode. Back in 2019 during Operation Swift Retort, there was no cyber footprint, but by 2021 work had commenced on creating the new command, which opened in May 2023 and started functioning in October 2024. PAF has created a cyber range, where cyber warfare skills are built up by pitching blue and red teams against each other. Elements of the PAF Cyber Force played an active role in achieving the right effects during Op Bunyan-un-Marsoos, when cyber was integrated with kinetic ops. PAF kept it all relevant by participating in operations and exercises like Indus Shield 24.

Breaking the news

News on this clash broke in Europe later that day (May 7) when the ISPR held a press conference.

The PAF's Deputy Chief of Air Staff (DCAS Operations) and Director General Public Relations (DGPR) took much of the world by surprise, when they claimed the PAF had shot down five IAF fighters. These included three, later increased to four, extremely capable 4.5-generation Rafales fitted with the cutting-edge Thales Spectra electronic warfare systems. The air-to-air kills were backed up by images from social media accounts and included GPS co-ordinates of where they crashed.

As the PAF's DCAS Ops disclosed at the press conference, attended by both local and international media, the IAF were continuously scrambling their fighters in the early hours, to reinforce and saturate the air defence. "Our strategy was to have force concentration in our selected AORs and fight to our own strength.

"Once they saw our numbers, the IAF fighters launched their ground weapons, and we identified them. As soon as this happened, the Chief changed the rules of engagement from 'deter' to 'sure kill'.

"We targeted the Rafales, because the IAF had always said they would make 'the difference'."

The DCAS (Ops) talked with the aid of a screen at the conference about the losses and the locations where they were shot down. The PAF had tapped into IAF Rafale communications, and listened to a four-ship 'Godzilla 1-4' formation in panic and distress, having discovered one of the French jets was missing.

He ran the recordings to assembled media, which was quite startling at the time, but it seems the Rafale pilots were mistakenly talking on an open frequency rather than a secure one. During the stand-off, the PAF identified 14 Rafales within the 72 aircraft, through its electronic intelligence systems, and then targeted them.

The PAF also struck the radar in the northern ICCS (Integrated Command and Control Centre) at Barnala which effectively stopped all communications between the IAF leadership and their fighters.

The Indian military fired Brahmos air/surface-to-ground missiles capable of speeds of 3,000km/h (1,900mph) one after the other. I was told by the PAF there had been 'soft kills' and 'hard kills' by the Brahmos. There is some suggestion the PAF jammed the Brahmos frequencies but no one would confirm this.

During the press briefing, the PAF spokesperson showed the radar signatures of the Brahmos on the screen, which he said missed targets and flew into Afghanistan.

After 52 minutes, the IAF fighters fled back to their bases, outwitted by the PAF. A senior officer, told the author: "The Rafale is potent

PL-15 amazes the world

The export version of the PL-15E was exhibited at Zhuhai in 2021 and again in 2024. The author was told the PAF's version had a range of around 190km (120 miles). The longest distance that any of the PAF missiles hit their target, was around 190km (120 miles). According to the International Institute of Strategic Studies (IISS) the PL-15 is known for its long-range capabilities and energetic boost-sustain motor. The 'boost-sustain' element is believed to refer to a two-stage motor, providing both initial acceleration and sustained flight. It makes it capable of speeds greater than Mach 5. After being fired and entering its terminal phase, the motor's second pulse will ignite, providing the additional thrust to increase kill probability at long distances. If the missile is launched at supersonic speed, as it would have been by the J-10Cs, it can maintain speeds of Mach 5+ for much of the flight. It will inevitably begin to slow down post motor burn out.

The PL-15/-15E is among a small number of AAMs that is guided by a miniature active electronically scanned array radar seeker that houses both active and passive modes. According to the IISS, Japan fields a BVR fitted with an AESA (AAM-4B) and there are suspicions that the US fields a AMRAAM version with an AESA that it doesn't export. According to the IISS, the missile features improved resistance to countermeasures and better performance against stealthy targets. It is also thought the hybrid guidance system supports a mini-course two-way datalink led by AEW&C aircraft.

The AEW&C can reportedly guide the missiles to their targets via Chinese XS-3 tactical data links, allowing them to be launched from a stand-off distance and "guided" to their respective targets... to remain undetected.

As a result, the PL-15E can be employed without relying on the onboard AESA radar for most of its flight, significantly reducing the likelihood of detection. The advantage of third-party targeting is in part that the launch aircraft may remain passive in the engagement.

Armed and very dangerous

'Cobras redefined' – the 15 Squadron patch worn by the J-10C pilots

A highly acclaimed J-10C Vigorous Dragon patch

Another PAF J-10C patch signifying two roles

Wg Cdr Bilal, Flight Cdr, Ops 15 Squadron, banks his jet to show off the four PL-15 missiles on the twin racks and single PL-10 on the outside hard points. The potent PL-15 struck a Rafale nearly 200km away. *Alan Warnes*

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The JF-17C Block 3s were armed with the PL-10 and PL-15s, which was not publicly acknowledged until just before India attacked Pakistan. They never shot down an Indian Air Force jet during Pakistan's Operation Bunyan-un-Marsoos, probably because the jet's KLJ-7A radar does not match the range of the J-10C's KLJ-10 PAF

enough, and while we initially declared we had shot down three, BS001 [17 Sqn], BS022, BS027 [both 101 Sqn], we also had it confirmed by HUMINT [human intelligence] in mid-July that BS021 [from 101 Sqn] had been confirmed as shot down, over Srinagar."

The author understands another four aircraft have not returned to the flightline. The PAF has their tail numbers, because they know from their electronic intelligence the jets that were badly damaged. They are endeavouring to confirm from OSINT (Open-Source Intelligence/HUMINT – often spies on the ground). The PAF refrained from attacking further than 2,000km (1,250 miles) away because it felt it could start an all-out war.

Rafale kills

The author, understandably, wanted to know how the PAF could identify the downed aircraft, as many of the Indian public will not believe it. As a retired officer explained: "In this BVR war, it's very difficult to show the wreckage of the jet you have shot down, because they fell in Indian territory. Although there were many images appearing on social media, our foe will never admit it, so what we do is judge the 'kill' with different parameters as most air forces do.

A close-up of an Indian Air Force Rafale kill on the side of a J-10C in mid-July PAF

No 29 Squadron is the PAF's Aggressor squadron, that commenced flying operations on January 23, 2019, just before Op Swift Retort took place on February 27, 2019. It is an integral part of the ACE facility, playing Red Air during exercises like Saffron Bandit and Indus Viper. The J-10C pilots have also trained as Aggressors and will undoubtedly be a big attraction for foreign air forces attending Indus Viper next year

"Our Identification (ID) Matrix is a structured process that ensures accuracy, accountability, and verification in air combat operations. It begins with the detection of an aircraft radar, followed by its positive identification within the Comprehensive Complete Air Picture (CCAP) at the command centre, where every Indian aircraft is clearly tagged and tracked.

"Once detection is confirmed, the next step involves assessing the lock parameters of the missile system, which can only engage a target within specific speed, range and angular limits. After securing a lock on the target, the missile is launched, and its progress is monitored through radar tracking. If the target's radar signature disappears from the CCAP screen, it is registered as a 'probable kill'.

"However, the process does not end there, upon returning to base, the pilot undergoes a thorough debrief in which the mission video recording is reviewed to validate that the missile engagement met all required parameters – direction, speed, lock range and envelope. This Multilayered ID Matrix not only guarantees the precision of engagements but also ensures transparency and post-mission verification, making it a cornerstone of the PAF's credibility in confirming air-to-air victories. Once these steps had been processed, the PAF tried to confirm the 'kills' by OSINT/HUMINT."

None of the above could be done without the seamless integration of radar inputs from multiple field radars and sector headquarters to create the CCAP at Command HQ. This process by the PAF ensures that data from geographically dispersed radars is fused into one unified, real-time operational display. Instead of each radar working in isolation, their coverage areas are digitally overlapped and synchronised, eliminating gaps and blind spots. The PAF achieves 360° surveillance of national airspace, enabling commanders to track, identify, and prioritise aerial threats with precision. It enhances situational awareness by filtering and corelating radar feeds, thereby reducing the duplication or misinterpretation of targets. As the senior officer told the author: "[Radar] Knitting symbolises the transition from localised radar control to network-centric defence system, empowering the PAF to maintain air superiority through unified awareness, co-ordinated response, and robust command and control."

The PAF provided the Rafale tail numbers, BS001, BS021, BS022 and BS027 to allow Dassault an opportunity to clarify if the aircraft was still current. Much of the Indian population and news channels still refuse to believe the Rafales were shot down, but while the IAF refutes these allegations, they have yet to provide post-May 7 images of the four jets with the serial numbers and close ups of their manufacturers' serial number.

Dassault has remained tight-lipped, although it did quite unusually put out a press release denying that its CEO Eric Trappier had said "no Rafales were shot down" after this was circulating on social media.

Sources told the author: "We have video recordings of the downed aircraft and battle damage assessment imagery which we intend to release at the time of our own choosing and when we deem it appropriate which will cause further embarrassment to the IAF."

Indian acknowledgement

The Indian Chief of Defence Staff, General Anil Chauhan, admitted to Bloomberg Television on May 31, that IAF jets had been shot down that night. He denied Pakistan's tally of six but declined to specify the exact number. "What is important is not the jet being [shot] down, but why they were downed," Chauhan said. "Numbers are not important."

He admitted tactical mistakes were made during the conflict, although he observed that the Indian military did carry out long-range precision strikes on targeted installations.

Chauhan finished: "The good part is that we are able to understand the tactical mistakes, remedy them, and implement them again."

His admission was overshadowed by a bolder statement from a political heavyweight in India, Subramanian Swamy, who acknowledged the loss of at least five Indian aircraft during the clash.

On August 9, Indian Air Force commander Marshal Amar Preet Singh, who has been in office since September 2024, prompted

Op Swift Retort

During Operation Swift Retort, an IAF MiG-21UPG Bison (serial no CU-2328) was shot down by a PAF F-16A piloted by Wg Cdr Nouman Ali Khan over Balakot on February 27, 2019.

The IAF Chief of the Air Staff at the time, ACM Birender Singh Dhanoa, claimed the MiG-21 pilot, Wing Commander Abhinandan Varthaman who was captured by Pakistan, had shot down a PAF F-16C with one of its R-77 *Adder* or R-73 *Archer* missiles, before it crashed.

This was simply untrue, as I had the opportunity to visit the MiG-21 wreckage sometime later, and the four missiles were all damaged but still intact. The US government also denied a F-16 had been lost.

The PAF also claimed a Su-30MKI *Flanker* was shot down that night, and while they did not have any verifiable wreckage, the AIM-120C missile that was fired by F-16B pilot, Wg Cdr Hassan Siddiqui, according to the PAF met all the parameters of a kill. The jet was later seen at an Anatolian Eagle exercise at Konya, Turkey sporting an Indian kill.

An IAF SPYDER (Surface-to-air Python and Derby) surface-to-air missile battery shot down a IAF Mi-17 helicopter in a friendly fire incident the same day, an incident that the IAF initially put down to 'a crash during to routine ops'. Seven months later, the IAF backtracked and confirmed it was indeed shot down by a SPYDER based at Srinagar Air Force Station ten minutes after it left the base. In 2023 the Chief Operations Officer (COO) of Srinagar AFS at that time, was dismissed from the IAF.

The Saab 2000 Erieye was the unsung hero of Op Bunyan-un-Marsoos, supporting the situational requirements of the fighter packages

ripples of disbelief while addressing an Air Force Association gathering in Bangalore by saying: "We shot down five PAF fighters and an AEW&C Erieye with our S-400 SAMs at a range of 300 kilometres."

Coming three months after the battle had concluded, it not only contradicted the earlier admission by his superior, General Chauhan, but also lacked any supporting evidence. It appeared to be a desperate attempt to placate Prime Minister Modi, whose government has been under mounting pressure to mask the scale of the IAF's losses. The stark contradiction between India's top military leaders underscores the turbulence within its defence establishment.

Training to fight Rafale

The IAF had bought 36 Dassault Rafales in 2016, along with MBDA Meteor BVRAAMs, MBDA Scalp EG/Storm Shadow cruise missiles and Safran AASM Hammer glide bombs. The author sensed during subsequent visits to the PAF, that it was a concern for the leadership. Undeterred, they set about training to fight the Rafale and the European BVRAAM. In 2020, the PAF ordered both the long-range PL-15 and short-range PL-10 missiles which could be a game changer against the Meteor.

The PAF's new tactics development school went into overdrive, employing the PAC/Chengdu JF-17 and Lockheed Martin F-16s against Rafales in simulations. Every possible avenue was exploited to understand the weaknesses of the French jet.

Asked if the air forces of Qatar or Egypt had helped with this? ACM Sidhu said: "No. Because neither side fly the Rafale in the same tactical manner as India does."

In the 1990s, before the PAF took delivery of the AIM-120 AMRAAM, it concentrated on within visual range (WVR) tactics, and according to the RAF and USAF pilots the author had talked to after exercises with them, they were very good at it. But it was different now.

Multi domain warfare

When ACM Sidhu became PAF Chief of the Air Staff on March 19, 2021, he ushered in some very big changes, realising the importance of different challenges of Air Power, and wanted to confront them through indigenous efforts.

On the operational side, he invested time and resources into new domains like cyber, electronic warfare and space, as well as ground-based air defences and unmanned aerial vehicles. He would then integrate them with the operational fighters in what he refers to as 'multi domain warfare'.

In June 2021, just three months after taking office, ACM Sidhu ordered 20, now much-prized Chengdu J-10Cs from China. They would be armed with the very long-range PL-15 and shorter-range PL-10 air-to-air missiles. The first six J-10Cs arrived on March 4, 2022. A multi-domain operations centre (MDOC) and a National ISR Air Ops Centre (NIIAOC) were two of many new departments the Commander created, where along with his staff and personnel, he could watch all these new assets interlinked while controlling the PAF's every move.

At the same time, the Airpower Combat Employment (ACE) facility at PAF Base Mushaf, created in 2016, was upgraded considerably into one of the best tactical training ranges in the world. In 2023 it was relabelled the Aerospace Power Centre of Excellence (ACE).

ACE is where PAF pilots and GCIs can test their capabilities and skills against each other and with international allies during Indus Shield exercises. Two have taken place to date, in 2023 and 2024. During the latter, 24 nations, including observers, participated with Royal Saudi Air Force Tornados, Turkish Air Force F-16C/Ds and Egypt F-16Cs present.

A senior officer told me: "We embraced fifth-dimensional warfare, with a highly effective cyber force that we built with support from the National Aerospace Science Technology Park [NASTP]. The aim is to support PAF ops, both kinetic and non-kinetic effects. We practice everything at ACE."

NASTP is an interesting development, a bold leap into the future that wasn't even an idea when the author last visited in 2020, where academia, industry and the government are linked together through an impressive ecosystem. It isn't just a technology park for innovation; it has been created to pursue the Air Chief's vision of a launchpad for strategic autonomy.

The level of intelligence being gleaned from India through different domains, as the author observed at the NIIAOC, is quite unbelievable. The author was allowed exclusive access to the facility, where even the most senior officers are often not allowed to visit.

Every Indian base could be monitored, every aircraft from the moment of lift-off in Western Command was tracked. There are Pakistani eyes everywhere. During my time with the PAF it was obvious there was nothing the PAF didn't know about the IAF.

From the start of the contingency op and as the tension with India escalated, the PAF Commander made the command centre his home, snatching sleep whenever possible on a mattress in a side room. He said he felt it was a once-in-a-lifetime opportunity and he didn't want to miss anything.

Alongside him in the command centre were the heads of all the new integrated domains, EW, Cyber and Space; there were air defence controllers, along with the head of the main kinetic force – the fighters in the air. He consulted with them, before making decisions in what the PAF calls 'centralised control and decentralised execution'.

Several officers who worked with the CAS, told the author how the 'boss', as they refer to him, took the lead on everything, even telling the J-10C pilots when and where to fire.

Sitara-i-Jur'at gallantry awards

Eight PAF pilots won Pakistan's third highest military award, the Sitara-i-Jur'at (Star of Courage), for their role in Op Bunyan-um-Marsoos

Rank/name	Role
Wg Cr Bilal Raza	Flt Cdr (Ops) 15 Sqn, Minhas
Wg Cdr Hammad Ibne Masood	2 i/c/Flt Cdr (Ops) 14 Sqn, Rafiqui
Sqn Ldr M Yousaf Khan	Sqn pilot, 14 Sqn Rafiqui
Sqn Ldr Muhammad O Ishfaq	Sqn pilot, 15 Sqn, Minhas
Sqn Ldr Muhammad H Anees	Sqn pilot, 15 Sqn, Minhas
Sqn Ldr Talal Hassan	Sqn pilot, 15 Sqn, Minhas
Sqn Ldr Fida Muhammad Khan	Sqn pilot, 15 Sqn, Minhas
Sqn Ldr Muhammad A Amir	Sqn pilot, 15 Sqn, Minhas

Indian strikes then a response

According to the IAF, retaliatory strikes took place at 11 different military air bases, on May 10. The bases included PAF Base Nur Khan near Rawalpindi, which was, according to the PAF, struck by Spice 2000 PGMs released by Mirage 2000s. It missed the HQ-9 missile battery at the facility.

Rafiqui was also struck, as was a hangar at PAF Base Murid, the home to four squadrons of UAVs, and the runway at Rahim Yar airfield that the IAF says plays a strategic role in Pakistan's air defences, but is a civil airport used by the UAE Royal family for hunting trips.

PAF Base Bholari was subjected to an attack on one of its hangars, that claimed the lives of five PAF personnel and damaged a Saab 2000 Erieye that the PAF says has been repaired. The runway at PAF Base Mushaf was struck but was made operational again within a few hours.

This Operation Swift Retort memorial at Mushaf, heralds the work of the based aggressors which claimed the shoot down of a Su-30MKI Flanker and highly publicised MiG-21 Bison

A close-up of the 29 Squadron memorial, giving all the names of the pilots on the unit during Op Swift Retort. The OC, Wg Cdr Nouman Ali Khan, shot down the IAF MiG-21 Bison with an AIM-120 AMRAAM 'Slammer' while flying a 11 Squadron jet

The 29 Squadron Aggressors' patch

A 16 Squadron JF-17C Thunder Block 3 taxies back to the unit's shelter area at Kamra-Minhas. The Black Panthers played a major part in the air defence of Pakistan on May 6/7 PAF

"They were sitting ducks - they didn't stand a chance when our J-10Cs unleashed those PL-15s."

In retaliation to the IAF offensive and loss of civilian lives, the PAF sent indigenous killer drones assembled by the NASTP into India flying over the bases at Adampur, Agra, Bhantral, Bhatwala, Bhuj, Gujrat, Srinagar and even the capital, Delhi, where they flew orbits overhead, packed with 20kg explosives. The drones with PAF's homegrown front and back-end technologies were not met with any resistance because the IAF's air defences had been blocked, and as a result the IAF was practically grounded.

Over the next few hours on May 10 the PAF hit 34 targets on different bases, half were by fighters, the rest were struck by the killer drones. While the PAF was initially aggressive, everything became measured, and more could have been taken out, according to a PAF senior officer, who told me they even had a lock on a A-50 AWACS lining up at Agra, but the attack was stopped, according to the PAF, so the IAF could save face.

For seven days, after the strikes ended, only one aircraft flew from Western Command and that was a Rafale that dropped a Scalp EG/ Storm Shadow cruise missile, working with an A-50 AWACS.

SEAD

One of the biggest threats to the PAF, alongside the Rafale, is the mobile S-400 air defence system. They needed them to be destroyed, because they are extremely dangerous. So much so, the PAF was monitoring their every move in Western Command – at Adampur, Bhuj and Bikaner.

The S-400 is a long-range Russian mobile surface-to-air missile (SAM) system - the SA-21 *Growler* - designed to destroy a wide range of aerial threats, including ballistic missiles, cruise missiles, aircraft and drones. It is considered one of the most advanced SAMs in the world, capable of engaging multiple targets simultaneously. Most NATO fighter forces train to counter the S-400 and will be very interested in how the PAF fared. The system has a range of up to 400km (250 miles), engage targets up to 100,000ft (30km) and track up to 300 targets, engaging 36 of them simultaneously. It is deadly.

The PAF was not keen to share the S-400's MAR (the distance from which the SAM can hit its target). Needless to say, the JF-17s needed to get close to the range of the S-400 to fire its two long-range supersonic Chinese-made CM-400AKG missiles.

In the early morning of May 10, a JF-17C Thunder Block 3 of 14 Sqn 'Tail Choppers' departed Rafiqui on a deadly Destruction of Enemy Air Defence (DEAD) mission, to destroy the S-400 system deployed to Adampur. As the JF-17 headed towards the target, the S-400's radars were being saturated by a substantial amount of jamming and other electronic warfare methods. At the same time, the JF-17 was spitting out decoys coupled with evasive manoeuvres.

As it got inside the S-400's firing range, the pilot was ordered to fire his CM400AKGs. He flew well inside the Rafale's Meteor's MAR but thankfully for the pilot, there was no resistance.

According to the PAF, the CM-400AKGs scored a direct hit on the 'Cheese Board' low altitude tracker and 'Big Bird' early warning and broad surveillance radars, and as a result put the S-400 missile launchers out of action. Three days later, the Indian PM, Narendra Modi, visited Adampur AFS, where he posed for a photo in front of a S-400 missile system to show that it was still operational. But as the PAF Commander said: "They didn't show him with the radar systems – without them it is useless."

The CM-400AKG is China's long-range air-launched air-to-ground weapon, powered by a solid-fuel rocket that can reach supersonic speeds of Mach 5. It is passive, so doesn't need to be guided onto the target by radar. The range of the S-400 missiles (up to 400km) is the same as the JF-17's CM-400AKG.

As the senior officer told me: "To get inside the range of an S-400 radar and come back alive is quite an achievement because you are giving the missile a chance to shoot you down. You must employ your game plan and the maximum range you can go. We employ scenarios through ACE and Combat Commanders School (CCS), flying them regularly again and again as we do on the squadrons." So, what happened was no different than what the PAF had trained for. Similarly, the PAF gave a crippling blow to the IAF by destroying the IACCS at Barnala.

Cobras

No 15 'Cobras' Squadron and its J-10Cs played a massive part in defeating India's ambitions on May 7. It is testimony to the way they train, that the pilots who went into battle only had between 100 and 120 hours on the Chinese jet. During the three years in service, they had spent much of their time devoted to air-to-air combat training in the likes of 2v2, 4v4, 8x8, 10v8 scenarios.

The current office commanding (OC), who for security reasons did not want to be identified, said: "In a relatively short span of three to four years, the PAF has inducted a new generation aircraft. While the Chinese have operated the J-10 for two decades, they haven't employed it the way we have and that's because of the PAF's training. The best pilots were recruited from the F-16 Viper and JF-17 Thunder forces and transferred to the J-10.

The IAF received their Rafales years before the PAF received its J-10s (the first five were delivered in July 2020) and they had more (36) too.

Incredibly, the six pilots who went to Chengdu in China to train on the J-10C, flew just two to three hours before ferrying six jets back to Kamra-Minhas in March 2022.

The PAF needed them quickly because of the rising Rafale threat, and within nine months they were operational. Much of that time was spent mastering the tactical sensors, working in all the different spectrums, including air-to-air refuelling. It took the PAF just eight months to get the jets to Pakistan after the contract was signed. Compare that to the Rafale in India, and the five to six years it took from contract signature to being operational.

The J-10C's KLJ-10 Active Electronically Scanned Array (AESA) radar improves detection and targeting in environments that pose a longer range over the F-16C Block 52's older mechanically scanned AN/APG-68 radar system, allowing the J-10C to engage targets from a much greater distance. PAF J-10Cs reached fully operational capability by early 2023 and were involved in a national level exercise the same year. The threats that PAF can simulate in J-10Cs are unlike anywhere else in the world.

The PAF's 'Radar Knitting' and 'ID Matrix' processes were extremely good during the air battle, while the rules of engagement were very clear, something that the IAF lacked in the conflict.

The 15 Sqn OC continued: "The CAS has brought ACE on a lot since 2016, back then it was more Air Power, than Aerospace and was more rudimentary for the pilots and fighter controllers. Now it includes air battle management and GBADs [ground-based air defences] and there is an operational interface with the Joint Strike Simulation Centre at ACE."

The author visited the ACE's Joint Services command and Staff College (JSSC) where students develop game plans, with air defence assets like GBADs alongside radars, electro-optical sensors and passive sensors enabling recognised air pictures. They then run it, to see how it works before they flew the mission. In the first international Indus Shield exercise at ACE in 2023, 14 countries attended and on the second in 2024 there were 24. A former Turkish Air Force F-35 pilot, now an F-16 Sqn Commander, told the OC 15 Sqn: "Indus Shield is similar to the USAF's Red Flag and in some domains better. vThe PAF is now working in a multi domain warfare and while very aggressive, they are disciplined."

Pakistan and India have already fought each other in two wars, since Pakistan gained independence in 1947. There have also been two major skirmishes between the PAF and IAF – Kargil in 1999 and Swift Retort in 2019, but this latest confrontation, that saw the biggest BVR air war ever witnessed anywhere in the world, is a sign that nothing will change anytime soon. With tension running high between the two nations, things could even get worse… **afm**

About the author

I have visited the Pakistan Air Force over 20 times, since first going to Pakistan in May 2001. I had not visited since 2020, due to family reasons and because the PAF was going through huge modernisation. This year, facilitated by the support of veterans and senior officers, I re-established my association with the PAF and had the privilege of visiting various facilities in July.

From being primarily fighter-centric when I last visited, the PAF has now emerged as a full-spectrum, multi-domain force operating seamlessly across space, cyber, artificial intelligence, drone warfare and integrated kinetic air power. As a result, the PAF I have observed now stands as a contemporary, forward-looking air force that is ready to meet the challenges of modern warfare head-on.

The author, Alan Warnes

Two JF-17C Thunder Block 3 of 8 Squadron 'Haiders' attended the Royal International Air Tattoo in July, and surrounded the specially marked jet with all the weapons in its inventory. This included the PL-15 and PL-10, as well as the large CM-400AKG seen here on the right Ben Stanley Hall

"We targeted the Rafales, because the IAF had always said they would make 'the difference'."

A JF-17C Block 3 Thunder of 16 Squadron spits out flares